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Medial Quadriceps Tendon Femoral Ligament Reconstruction After Patellectomy: A Treatment for a Dislocating Quadriceps Tendon

Laurie A. Hiemstra, MD, PhD,
FRCS

Bevan Frizzell, MD, FRCPC

Sarah Kerslake, MSc, BPhy

From Banff Sport Medicine, Banff, Alberta, Canada (Dr. Hiemstra and Ms. Kerslake); the Department of Surgery (Dr. Hiemstra) and Department of Radiology (Mr. Frizzell), University of Calgary, Calgary, Alberta, Canada.

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Abstract

The medial quadriceps tendon femoral ligament (MQTFL) reconstruction is an alternative to the patellar bony fixation of the medial patellofemoral ligament reconstruction for the treatment of lateral patellofemoral dislocation. We describe the first report of a unique application of this technique in a patient with a previous patellectomy to treat a dislocating quadriceps tendon. An active 59-year-old Caucasian man presented 25 years after patellectomy with a dislocating quadriceps tendon and significant dysfunction. Stabilization of the knee extensor mechanism with an MQTFL reconstruction and retensioning of the quadriceps complex by tibial tubercle distalization provided stability and improved function. Extensor tendon instability is a rare complication after patellectomy that can cause significant pain and dysfunction. Successful stabilization of the quadriceps mechanism through an MQTFL reconstruction can provide excellent patient satisfaction and functional results. This technique may have implications for patellofemoral instability surgeries and in cases of knee extensor dysfunction after total knee arthroplasty.

The medial quadriceps tendon femoral ligament (MQTFL) reconstruction was described by Fulkerson and Edgar¹ as an alternative to the medial patellofemoral ligament (MPFL) reconstruction. This technique involves weaving the graft through the quadriceps tendon rather than anchoring it to the patella through bone tunnels or suture anchors. Because the MPFL has attachments to the quadriceps tendon, this technique allows for anatomic reconstruction of the MPFL

without the potential risks of bony fixation such as patella fracture. This case report describes a unique application of this technique in a patient with a previous patellectomy done to treat a dislocating quadriceps tendon.

Case Presentation

The patient is a healthy 59-year-old man who suffered a severe injury to his left leg 25 years ago, which resulted in fractures of his femur and

Figure 1



Preoperative lateral and AP radiographs displaying the intramedullary femoral nail and patellectomy.

patella. He had a femoral intramedullary nail inserted and a total patellectomy to address his comminuted patella fracture. He was active and doing well until, while ice skating, he heard a pop in his left knee and fell to the ice. He had difficulty weight bearing for several days after this incident and demonstrated moderate swelling in his knee. After this injury, he reported ongoing episodes of his quadriceps tendon dislocating laterally.

Physical examination revealed neutral alignment of his lower extremities. His Q angle at 30° of flexion was 12° bilaterally. There was moderate quadriceps wasting on the left compared with the right leg. He had a 5° quadriceps lag on the left and was unable to extend his left knee completely from a sitting position. Single-leg squat demonstrated excellent control and depth on the right compared with the left. Examination of his cruciate and collateral ligaments was unremarkable. He had no evidence of generalized ligamentous laxity, with a Beighton score of 0/9. There were no

rotational abnormalities of his femur or tibia.

Preoperative imaging included plain radiographs (Figure 1), an ultrasound, and a magnetic resonance imaging (MRI). The ultrasound showed that the quadriceps tendon was riding on the lateral trochlear ridge. The MRI demonstrated that the broad, thickened common quadriceps-patellar tendon was subluxated laterally, centered over the lateral trochlear ridge. The tibial tuberosity-trochlear groove distance was elevated at 21 mm. The trochlea was developmentally shallow (Dejour type A). High-grade chondrosis was present over most of the lateral trochlea. Plain radiographs were unremarkable, noting the presence of the intramedullary femoral nail and patellectomy.

Nine months after his injury, the patient underwent an MQTFL reconstruction,¹ tibial tuberosity distalization, and a lateral release. The goal was to stabilize the extensor mechanism and to retension the quadriceps to improve functional strength. Intraoperative arthroscopy

findings included a 4 × 5 cm area of grade IV chondral damage, where the extensor tendon had been articulating on the lateral trochlea. The remainder of the knee was unremarkable. After the arthroscopy, a tibial tubercle osteotomy was performed with a distalization of 7 mm and medialization of 7 mm. An extensive lateral release was performed to allow the tendon to track in the trochlear groove and to release the adhesions from his previous surgery. After the tubercle osteotomy and lateral release, the extensor mechanism was located in trochlear groove throughout full passive range of motion but was still easily dislocatable with minor lateral pressure. The MQTFL reconstruction was performed as described by Fulkerson and Edgar¹ using an autograft semitendinosus tendon. It was cut to 22 cm and sutured on each end. The graft was woven through the quadriceps tendon just proximal to the normal location of the patella, where there was uninjured strong tissue. The graft was brought through layer two of the knee and inserted into the anatomic insertion point of the MPFL on the femur, distal to the adductor tendon and posterior to the medial epicondyle.²

Postoperatively, the left knee was locked in extension in a knee brace for 4 weeks, after which progressive active range of motion was allowed. Quadriceps activation exercises were allowed immediately postoperatively. The brace was discontinued at 6 weeks postoperative and full range of motion was permitted. The patient was able to perform a straight leg raise with no quadriceps lag by 3 weeks postoperative, which had not been attainable preoperatively. Knee flexion range of motion measured with a goniometer was 60° at 8 weeks postoperative, and 90° at 12 weeks postoperative. Knee range of motion at 6 months postoperative was measured as zero to 115° on the left compared with zero to

Figure 2



Postoperative AP and lateral radiographs demonstrating the 7-mm medialization and 7-mm distalization tibial tubercle osteotomy.

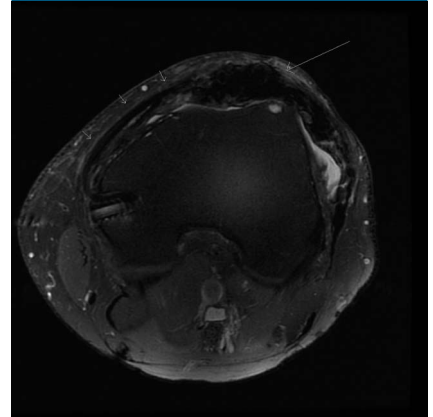
130° on the right leg. The quadriceps tendon was stable. Postoperative imaging demonstrated a well-healed tibial osteotomy and accurate placement of the MQTFL femoral tunnel compared with the reference standard of the Schottle point³ (Figure 2). Postoperative MRI demonstrated normalization of the tibial tuberosity-trochlear groove distance to 12 mm (Figure 3). The MRI also demonstrated that the common quadriceps-patellar tendon had been shifted medially, with the bulk now centered over the femoral trochlea. Two distinct, intact bands of allograft tissue connected the common extensor mechanism to the medial femoral condyle.

At 1 year postoperatively, the patient reported significant functional improvement and stability of his left knee. He reported that he had ridden his bike over 4,000 km throughout the summer. On examination, he had no circumference deficit of his quadriceps

muscles when measured at 3, 5, and 10 cm proximal to the superior patella border. The Banff Patellar Instability Instrument (BPII) score, a quality-of-life measure for patellofemoral instability, was recorded as 76.6/100. The surgeon's global rating score for 1-year outcomes was excellent.

At 3 years postoperatively, the patient reported that he was very satisfied with the outcome of his procedure, rating it as 9/10 on a 10-cm visual analog score scale. The patient was able to bicycle almost 7,000 km annually and reported being able to ski with no symptoms in his knee. The BPII score was assessed as 98.9/100. Knee range of motion was measured as R7-133° on the right compared with R5-124° on the left. Manual muscle testing strength was assessed as 5/5 bilaterally for both hip adduction and abduction, with 4/5 hip internal rotation and 5/5 hip external rotation. This was compared

Figure 3



Postoperative axial proton density fat saturated sequence demonstrates the medial quadriceps tendon femoral ligament graft (small arrows) and medialized component of the common extensor tendon (large arrow).

with full 5/5 strength of the contralateral nonoperative limb. Knee extension manual muscle testing was 4/5 on the left compared with 5/5 on the right. The patient reported that he was able to perform a straight leg raise on either leg while wearing his skis. Thigh circumference measured at 3 and 10 cm proximal to the superior border of the patella was 40.4 and 44.2 cm, respectively, on the left, compared with 43.5 and 48.3 cm, respectively, on the right leg. The patient has had no further episodes of subluxation, instability, locking, or catching in the operative knee.

Gait demonstrated equal stride length and good bilateral control throughout the swing and stance phases. Functionally, the patient was able to perform full double-leg squats with excellent control, as well as single-leg squats with good control and depth on his operative left leg, compared with excellent control and depth on his right. Additionally, left single-leg balance assessed on a Bosu ball was within 3 seconds of the right limb. Results of the single-leg hop for distance demonstrated a distance of 1.19 m on his

nonoperative right leg compared with 0.68 m on his left. His single-leg triple hop for distance and crossover hop for distance, however, were both within 90% of the contralateral nonoperative right leg.

Discussion

This case describes an unusual complication after patellectomy of a subluxating extensor mechanism that was stabilized by performing an MQTFL reconstruction. This was completed in combination with a tibial tubercle medializing and distalizing osteotomy, which improved the tension in the extensor mechanism to optimize strength and function.

Patellectomy is considered a salvage procedure, and postoperative complications are common, including osteoarthritic degeneration, extensor tendon rupture, extensor tendon dislocation, quadriceps tendon ossification, quadriceps weakness, pain, and dysfunction.⁴⁻⁸ In 2014, Cavaignac et al⁵ published a systematic review on the results of patellectomy in patients without a prior total knee arthroplasty. They analyzed 31 articles describing 1,416 knees with a mean follow-up of 7 years and reported a 20.3% complication rate. There were only four reported cases involving a dislocation of the extensor mechanism. This represents merely 1.8% of all the complications recorded and 0.36% of the patellectomies performed. Ackroyd et al⁹ reported on three cases of anterior knee pain and extensor mechanism instability after patellectomy. Of these seven cases of dislocating extensor mechanism reported in the literature, five were managed operatively with either a tubercle transfer ($n = 2$) or a patellofemoral arthroplasty with lateral release and medial reefing ($n = 3$), with good results.

In addition to instability of the extensor mechanism, weakness of

knee extension is also a reported issue after patellectomy. Watkins et al¹⁰ performed Cybex testing after patellectomy and demonstrated that quadriceps strength was significantly impaired postoperatively. The patient group in this study was relatively early postoperative, at 14 to 42 months; however, these results are similar to those reported by Lennox et al¹¹ for 69 patients and 83 knees assessed 12 to 48 years after patellectomy. Hill et al¹² reported on the correlation of knee extensor strength and outcome after patellectomy. These authors determined that patients with a quadriceps strength loss of 45% or less had superior postoperative outcomes.

In this case report, the patient initially described a significant dysfunction from the instability of the knee extensor mechanism as his main concern. Although reduced function and strength of the injured knee were noted as an issue after the patellectomy, the patient reported moderately good function until he developed the extensor mechanism instability. The surgical intervention combined an MQTFL reconstruction with a tibial tubercle distalization to address both of these patient concerns. After the tubercle osteotomy and lateral release, the extensor mechanism continued to be readily dislocatable with only slight lateral pressure. The realignment procedure served to improve the biomechanics about the knee, especially regarding tensioning the quadriceps; however, the MQTFL reconstruction was required to provide stability to lateral translation of the extensor mechanism. Postoperative rehabilitation was phase-based to encourage functional performance gains, with a particular focus on strengthening of the core, hip, and thigh musculature. Through surgical stabilization and retensioning of the extensor mechanism, the patient was able to achieve

significantly improved function and participation in demanding recreational activities.

Conclusions

Extensor tendon instability is a rare complication after patellectomy that can cause significant pain and dysfunction. Successful stabilization of the quadriceps mechanism through an MQTFL reconstruction as described in this case report can provide excellent patient satisfaction and functional results.

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